

STUDIES IN THE
COMPOSITAE-EUPATORIEAE VIII.
OBSERVATIONS ON THE
MICROSTRUCTURE OF STEVIA.

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During the past two years we have examined many genera and species of the tribe Eupatorieae microscopically in an effort to clarify generic concepts. The methods followed are essentially those outlined in the revision of the *Hofmeisteria* complex (King & H. Robinson, 1966). By applying these methods to the genus *Stevia*, distinctive microscopic characters have been recognized and a distinct genus, *Cronquistia* (King 1967) has been segregated. During this process a number of microscopic characters of possible specific or even subgeneric value have been observed. Among these characters are variations in pollen form (King & H. Robinson 1968), corolla pubescence, and pubescence on the achene. A brief summary of these characters is offered here with some suggestions as to their possible taxonomic significance.

Most of the observations were made from material in the U.S. National Herbarium. The loan of a large number of types of *Stevia* from the Gray Herbarium is gratefully acknowledged. Attempts have been made to correct for synonymy or misdeterminations where these are known; however, since a complete monographic review has not been undertaken, some of the cited material may be misnamed.

I Pubescence of the achene.

Essentially all species of *Stevia* examined have distinct setae borne on the ribs of the achenes, a character similar to most other genera of the tribe. In some specimens of *Stevia* these setae are very short and may be essentially lacking. One Mexican species, *S. monardaefolia* H.B.K., the achenes are usually nearly to completely without pubescence.

In certain species, mostly South American, the setae of the achenes are intermixed with glands. Such glands have been seen on the following species from southern Brazil and adjacent areas.

S. ammotropha B.L. Robins. (*Hassler* 9347, GH, type).

S. aristata D. Don ex Hook & Arn. (*Gillies* 162, GH, isotype).

S. balansae Hieron. (*Hassler* 5955, GH, type of *S. hassleriana* Chod.)

S. burkartii B.L. Robins. (*Burkart* 1149, GH, type).

S. entreriensis Hieron (*Lorentz* 952, US, type).

S. guaranítica Chod. (*Hassler* 6617).

S. ophryophylla B.L. Robins. (*Brade* 7084, GH, type).

S. rebaudiana Bertoni (*Jack* 5353, US).

S. sarensis B.L. Robins. (*Steinbach* 7048, GH, type).

S. sarensis B.L. Robins. var. *dissiticeps* B.L. Robins. (*Steinbach* 6248, GH, isotype).

S. villaricensis (B.L. Robins.) Cabrera & Vittet (*Jørgensen* 4267 in part, GH, type).

In structure these glands are like those of the corolla. If the few specimens examined are indicative, there is some variation between species in the relative numbers of setae versus glands. In *S. burkartii* there seem to be no setae. In *S. aristata*, *S. ophryophylla*, and *S. rebaudiana* a few distinct setae are present. In *S. ammotropha* the setae are concentrated at the lower end of the achene with mostly glands upward. In *S. guaranitica*, *S. hassleriana*, and *S. sarensis* glands are relatively sparse and intermixed among the setae.

Many of the species with glands on the achenes have ten or more pappus setae. Of the multiaristate group B.L. Robinson (1930) made the following remark:

“... in the multiaristate series represented by Types VIII and IX there are a very few (chiefly Brazilian) species in which the awns usually range from seven to twelve, but sometimes drop to four, five or six. Thus the separation between the pauciaristate and multiaristate series would seem to break down. However, it is clearly a natural distinction of some importance.”

It would seem that this Austral element in the genus *Stevia* is a distinctive series in which both multiaristate pappus structure and glandular achenes are found. The two characters are not completely correlated in their occurrence and no single unifying character for all the species having either character is presently known.

In one Mexican species, *S. vernicosa* Greenman (*Pringle* 7698, type GH), glands are present on the achene. In other characters this species is related to *S. salicifolia*, in a species group lacking glandular achenes. Occasionally glands have been observed on the achenes of other species such as *S. lucida* (*Purpus* 3036, US, type of var. *pueblensis* B.L. Robins., a specimen in which achene-type setae also occur in the corolla tube) and *S. dictyophylla* B.L. Robins. (*Pringle* 2832, GH), but as yet no gland bearing achenes have been observed in species showing the modified pollens discussed below.

II Pollen variation.

An element in the genus apparently representing the opposite pole from the multiaristate and glandular achened species is that showing pollen variations. The extreme variations in two Mexican species, *S. pilosa* Lag. and *S. purpurea* Pers., have already been reviewed (King & H. Robinson, 1967). The taxonomic usefulness of pollen types is limited by the variation in individual species, and only careful evaluation of many specimens of each will reveal in which species the variations oc-

cur. Nevertheless, the available sample indicates the variations are centered in Mexico. A few widely distributed species ranging from Mexico as far south as Peru have modified pollen. Pollen variations have not been found in any of the multiaristate or glandular achened species. This suggests that the variations are restricted to a second large subgroup within the genus *Stevia*. No other character distinguishing the subgroup is presently known.

The types of pollen observed in *Stevia* are as follows:

Aborted—In flowers that are otherwise completely mature, anthers are underdeveloped and distinct pollen grains are absent.

Type I—Pollen grains spherical, averaging 25μ in diameter, tricolpate, usually radially symmetric.

Type II—Pollen grains spherical, averaging $30-40\mu$ in diameter, the intersecting furrows usually very asymmetrically arranged.

Type III—Pollen grains elongated, short cylindrical or dumbbell shaped, lesser axes $30-35\mu$ in diameter, surface features similar to those of Type II but complicated by the elongate or double nature of the grain.

The pollen types are uniform throughout any one specimen, but type I & II, and types II & III have been seen mixed together in anthers of some specimens.

Anthers with pollen apparently aborted have been observed in only *S. pilosa* and *S. purpurea* where a full range of pollen variation is known to occur (King & H. Robinson, 1967).

Pollen type I seems to be the basic pollen type of the genus, and has been observed in all of the species restricted to South America, and in at least some specimens of most Mexican and Central American species. The presence of this pollen type seems to have no taxonomic significance and grains seem to be of the same form in all species.

Pollen type II has been observed in the following species:

- S. alatipes* B.L. Robins. (Pringle 10124, US, type).
- S. clinopodioides* Greenm. (Pringle 6594, US, isotype).
- S. connata* Lag. (Bourgeau 3243, US).
- S. cordifolia* Benth. (Hartweg 304, GH, type frag.).
- S. deltoidea* Greene (Pringle 4976, GH, isotype).
- S. elliptica* Hook. & Arn. (Sinclair s.n., US, type frag.).
- S. elongata* H.B.K. (King & Soderstrom 5111, US; Jahn 1098, US as var. *caracasana* (DC) B.L. Robins.).
- S. jorullensis* H.B.K. (Pringle 4973, US).
- S. lehmannii* Hieron. (Lehman 5199, US, type).
- S. liebmannii* Sch. Bip. ex Klatt (Liebmann 125, US, type frag.; Purpus 9100, US, isotype of var. *chiapensis* B.L. Robins.; Pringle 4974, US, type of *S. decumbens* Greene).
- S. micradenia* B.L. Robins. (Pringle 5051, US, isotype as *S. laxa* B.L. Robins. & Seaton).

- S. monardaefolia* H.B.K. (*Pringle* 743, GH, type of *S. amblyolepis* var. *umbratilis* B.L. Robins.).
- S. nepetaefolia* H.B.K. (*Purpus* 1484, US).
- S. orizabensis* B.L. Robins. (*Bourgeau* 3331, GH, type).
- S. paniculata* Lag. (*Carter & Chisaki* 3475, US).
- S. pilosa* Lag. (*Berlandier* 663, 793, 808, on one sheet, US, type of *S. conferta* var. *puberula* DC., & see King and H. Robinson, 1967).
- S. plummerae* A. Gray (*Lemmon* 2730, US, type; *Pennell* 19216, US; *Lemmon* 2731, US, type of var. *alba* A. Gray; *Pringle* 10106, US, type of var. *durangensis* B.L. Robins.).
- S. purpurea* Pers. (see King and H. Robinson, 1967).
- S. purpusii* B.L. Robins. (*Pringle* 11294, US, isotype).
- S. reglensis* Benth. (*Hartweg* 308, GH, type frag.).
- S. rhombifolia* H.B.K. (*Cronquist* 9555, US; *Palmer* 958 in 1896, US, type of f. *colorata* B.L. Robins.).
- S. satureiaefolia* Sch. Bip. var. *hirsuta* (Hook. & Arn.) Baker (*Cronquist* 9720, US).
- S. seemannii* Sch. Bip. (*Seeman* 2041, GH, type; *Seler* 1602, GH, type of var. *selerorum* B.L. Robins.).
- S. serrata* Cav. (*Palmer* 750 in 1896, US, isotype of var. *haplopappa* B.L. Robins.; *Pringle* 7652, GH, type of var. *arguta* B.L. Robins.; *Pringle* 8229, US, type of *S. tephra* B.L. Robins.).
- S. tomentosa* H.B.K. (*Seaton* 487, GH, type of var. *seatonii* B.L. Robins.).
- S. viscida* H.B.K. (*Pringle* 10092, US, isotype of *S. lozanoii* B.L. Robins.; *Palmer* 791, US).

All of these species occur in Mexico with *S. plummerae* ranging northward into the United States and *S. serrata* and *S. elongata* ranging southward into South America. In addition to *S. pilosa* and *S. purpurea*, there are other specimens of three of these species, *S. elatior* var. *podophylla* B.L. Robins. (*Purpus* 3132, type US), *S. monardaefolia* (*Goldman* 116, type of *S. amblyolepis* B.L. Robins., GH), and *S. rhombifolia* (*Pennell* 18504, var. *stephanocoma* f. *glandulifera* B.L. Robins., US; *H.S. Gentry* 7304, var. *stephanocoma* Sch.-Bip., US; *Palmer* 958 in 1896, var. *typica* f. *colorata* B.L. Robins., type US) in which additional pollen type (type I) occurs. In another species, *S. serrata*, in the three specimens cited, pollen types I and II are intermixed in the anthers.

It is very difficult to reconstruct the actual pattern of the furrows in the pollen type II grains because of variation from one grain to another and the lack of symmetry. However, a number of species have been carefully reviewed and *S. alatipes* (Figs. 2-5), *S. connata* (Fig. 6), *S. elongata* (Figs. 7-9), *S. monardaefolia* (Figs. 10-11), *S. pilosa*, *S. purpurea*, *S. purpusii* (Figs. 14-16), *S. rhombifolia* (Figs. 17-18), *S. satureiaefolia* (Figs. 19-22), and *S. viscida* (Fig. 23) all have pollen type II that is essentially the same. In these (type IIa) the surface is dissected by the furrows into four spinose plates. In some grains more plates may be

present but these have not been observed with certainty. The commonest form of grain has one rectangular plate extending $\frac{3}{4}$ of the way around the grain, and at one corner this largest plate is usually narrowly attached to two adjacent smaller plates. Modifications include grains with two rectangular plates extending halfway around the grain. A number of more irregular arrangements have been observed (Figs. 16, 18). In *S. viscida*, the grains seemed to have unusually wide furrows.

In another group of species with pollen type II the structure seems basically different. These include *S. plummerae* (Figs 25-29), *S. seemannii* (Figs. 30-32), and *S. tomentosa* var. *seatonii* (Figs. 36-38). None of these show the forms of pollen that are most common in the previously listed species. In all of these the pollen grains (type IIb) seem to have the surface usually divided into five plates, and none of the plates extend more than halfway around the grain.

In one species, *S. micradenia*, a very distinctive pollen form is present. Many grains (type IIc) show seven plates, one at each end and five arranged symmetrically around the sides (Figs. 39-45). Such grains have not been observed in any other species. In the specimen examined these grains are intermixed with others showing four or five plates asymmetrically arranged.

After exhaustive examinations it may be possible to determine patterns of relationship in the pollen type II. The difficulty in determining exact structure and the variability within species will limit the use of pollen in identification of species.

Pollen type III has been seen in only *S. pilosa* and *S. purpurea*. It is known from four specimens of *S. pilosa* and one specimen of *S. purpurea* (King & H. Robinson, 1967). On the basis of these specimens each species seems to have a distinctive form of pollen type III. The type II grains of these species are essentially alike, and the differences in type III may be only the result of relative orientation of basic type II features on the elongate (double?) grain. In *S. pilosa* the furrows are transverse and circle the grain (Figs. 12-13). In *S. purpurea* the furrows tend to be longitudinal. Certainly, type III pollens hold the greatest potential for specific distinctions and further records of this pollen type should be sought in *S. pilosa*, *S. purpurea*, and other species.

III Corolla pubescence.

It would seem that the well known variability of pubescence on leaves, stems, and bracts of Compositae has prejudiced taxonomists against the character completely. It is, in fact, rather surprising to discover that pubescence on the corolla in many Eupatorieae is apparently a generic character as shown in the study of the *Hofmeisteria* complex (King and H. Robinson, 1966). Though such pubescence has been observed previously with low magnification, critical features can be observed only by use of the compound microscope. In *Stevia*, as in the *Hofmeisteria* complex, the genus shows certain distinctive pubescence characters including

the presence of both glands or glandular hairs on the outer surface and long glandless hairs on the inner surface in all species, and the presence of usually shorter and thicker-walled hairs on the outer surface in most species.

On the basis of a present small sampling of specimens many species seem to be distinctive in form and actual arrangement of the hairs on the outer surface of the corolla. The most distinctive group is that completely lacking hairs on all or at least the upper part of the outer surface. The following species completely lack hairs:

S. glutinosa H.B.K. (Morley 653, US).

S. pyrolaefolia Schlecht. (H.E. Moore 1738, US).

S. salicifolia Cav. (Cronquist 9531, US; Rose, Painter, Rose 8275, US).

S. salicifolia Cav. var. *anathera* B.L. Robins. (Palmer 401, US, isotype).

S. salicifolia Cav. var. *integra* (Blake) B.L. Robins. (Purpus 4722, US, type).

S. salicifolia Cav. var. *nana* A. Gray (Parry & Palmer 326 in 1878, US, type).

S. salicifolia Cav. var. *virgulifera* B.L. Robins (Palmer 29 in 1896, US, isotype).

S. venosa A. Gray (Palmer 376 in 1885, US, type).

S. vernicosa Greenm. (Pringle 7698, GH, type).

The following species have hairs only on the base of the corolla:

S. lucida Lag. (McVaugh 10031, US).

S. lucida Lag. var. *bipontini* B.L. Robins. (Liebmann 128, US, Isotype frag. of *S. grandidentata* Sch. Bip.).

S. lucida Lag. var. *opaca* B.L. Robins (Seamann 2028, GH, type).

S. lucida Lag. var. *pueblensis* B.L. Robins. (Purpus 3036, US, type).

S. nelsonii B.L. Robins. (Nelson 6579, US, type).

S. salicifolia Cav. var. *collodes* (Greenm.) B.L. Robins. (Pringle 8570, US, isotype).

The species of these two groups show a number of characters of interest and are considered in more detail in the following section.

The following species have hairs only on the upper part of the corolla:

S. ammotropha B.L. Robins. (Hassler 9347, GH, type).

S. berlandieri A. Gray (Berlandier 3160, US, type).

S. bridgesii Rusby (Bang 3047, US, type).

S. dictyophylla B.L. Robins. (Hartweg 137, GH, type as *S. subpubescens* Benth.).

S. guaranitica Chod. (Hassler 6617, US).

S. hypericifolia Hieron. (Regnell III 677, GH, isotype).

S. lehmannii Hieron. (Lehmann 5199, US, isotype).

S. monardaefolia H.B.K. (Goldman 116, GH, type of *S. amblyolepis* B.L. Robins.).

S. monardaefolia H.B.K. var. *macrophylla* B.L. Robins. (Pringle 8057, US, isotype).

- S. monardaefolia* H.B.K. var. *repens* B. L. Robins. (*Mexia* 1610, US, type).
- S. neurophylla* B.L. Robins. & Greenm. (*Nelson* 2133, US, type).
- S. polycephala* Bertol. (*J.D. Smith* 2327, US, type of *S. arachnoidea* B.L. Robins.).
- S. plummerae* A. Gray (*Lemmon* 2730, US, type; *Palmer* 328 in 1885, US, type of *S. madrensis* A. Gray).
- S. plummerae* A. Gray var. *alba* A. Gray (*Lemmon* 2730, US, type).
- S. plummerae* A. Gray var. *durangensis* B.L. Robins. (*Pringle* 10106, US, type).
- S. reglensis* Benth. (*Hartweg* 308, GH, type frag.; *Pringle* 6530, US).
- S. scabrella* Benth. (*Hartweg* 141, GH, type).
- S. seleriana* B.L. Robins. (*Seler* 1695, GH, type).
- S. seemannii* Sch. Bip. (*Seamann* 2041, GH, type).
- S. selloi* var. *ypacarayensis* B.L. Robins. (*Hassler* 12154, US, type).

In *S. bridgesii* and *S. reglensis* the hairs are very small and sometimes difficult to see. In this group the corolla is usually covered with glands below but *S. neurophylla* has glands very sparse on the corolla nearly bare below.

In the following species the hairs are mostly on the upper part of the corolla, scattered in the middle and very sparse below:

- S. alatipes* B.L. Robins. (*Pringle* 10124, US, type).
- S. balansae* Hieron. (*Hassler* 5955, GH, type of *S. hassleriana* Chod.).
- S. berlandieri* A. Gray var. *anadenotricha* B.L. Robins. (*Palmer* 257 in 1885, US, isotype).
- S. clivicola* B.L. Robins. (*Mandon* 143 in part, GH, type).
- S. dictyophylla* B.L. Robins. (*Pringle* 2832, GH).
- S. dissitifolia* DC. (*Martínez* 129, US).
- S. elliptica* Hook. & Arn. (*Sinclair* s.n., US, type frag.).
- S. elongata* H.B.K. (*King & Soderstrom* 3111, US).
- S. elongata* H.B.K. var. *caracasana* (DC.) B.L. Robins. (*Langlassé* 775, US).
- S. eupatoria* Willd. (*H.E. Moore* 3506, US).
- S. filipes* Rusby (*R. S. Williams* 124, US, type).
- S. flourensioides* Blake (*Purpus* 1470, US, type).
- S. liebmannii* Sch. Bip. ex Klatt (*Liebmann* 125, US, type frag.).
- S. micradenia* B.L. Robins. (*Pringle* 5051, US, isotype as *S. laxa* B.L. Robins. & Seaton).
- S. microchaeta* Sch. Bip. (*Liebmann* 120, US, isotype?).
- S. monardaefolia* H.B.K. (*Pringle* 743, GH, type of *S. amblyolepis* var. *umbratilis* B.L. Robins.).
- S. pelophila* Blake (*García* 387, US, type; *Maysilles* 7594, US).
- S. phlebophylla* A. Gray (*Palmer* 676 in 1886, US, type).
- S. pilosa* Lag. (see *King & Robinson*, 1967; *Berlandier* 663, 793, 808, US, type of var. *puberula* (DC.) B.L. Robins.).

- S. polycephala* Bertol. (*Skutch 170*, US).
S. purpurea Pers. (see King & Robinson, 1967).
S. revoluta B.L. Robins. (*Purpus 2539*, US, type).
S. tephrophylla Blake (*Goldman 1049*, US, type).
S. viscida H.B.K. (*Pringle 10092*, US, isotype of *S. lozanoi* B.L. Robins.; *Lemmon 2729*, US, type of *S. amabilis* Lemmon; *Palmer 791*, US).

This group intergrades considerably with the next, and some species seem to vary, but the apparently related *S. pilosa*, *S. purpurea*, and *S. viscida* seem to consistently show this type.

The following species have hairs prominently above and below but sparse or lacking between:

- S. andina* B.L. Robins. (*A.S. Hitchcock 21475*, US, type).
S. aschenborniana Sch. Bip. (*Cronquist 9734*, US; *Pringle 6608*, US, isotype of *S. diffusa* Greenm.).
S. bangii Rusby (*Bang 86*, US, isotype).
S. bangii var. *dyscrita* B.L. Robins. (*Buchtien 186*, GH, type).
S. benderi Perkins var. *cardenasii* B.L. Robins. (*Cardenas 480*, GH, type).
S. burkartii B.L. Robins. (*Burkart 1149*, GH, type).
S. camachensis Hieron. (*Fiebrig 2868a*, US, type).
S. chacoensis R.E. Fries (*Fries 1388*, US, isotype).
S. chamaedrys Griseb. (*Lorentz & Hieronymus 171*, US, isotype).
S. connata Lag. (*Bourgeau 3243*, US).
S. cordifolia Benth. (*Hartweg 304*, GH, type frag.).
S. deltoidea Greene (*Pringle 4976*, GH, isotype).
S. discolor B.L. Robins. (*Mandon 242* in part, GH, type).
S. eclipses B.L. Robins. (*Fiebrig 3126*, US, type).
S. elatior H.B.K. var. *podophylla* B.L. Robins. (*Purpus 3132*, US, type).
S. entleriensis Hieron. (*Lorentz 952*, US, type frag.).
S. fiebrigii Hieron. var. *gracillima* B.L. Robins. (*Venturi 3679*, US, type).
S. gilliesii Hook. & Arn. (*T. Stuckert 17106*, GH, isotype).
S. glandulosa Hook & Arn. (*Sinclair s.n.*, US, isotype).
S. jorullensis H.B.K. (*Pringle 4973*, US).
S. karwinskyana Steud. (*Purpus 2856*, US).
S. leucosticta B.L. Robins. (*Macbride & Featherstone 1382*, GH, type).
S. liebmannii Sch. Bip. ex Klatt var. *chiapensis* B.L. Robins. (*Purpus 9100*, US, isotype).
S. macbridei B.L. Robins. (*Macbride & Featherstone 1613*, GH, type).
S. macbridei var. *anomala* B.L. Robins. (*C.L. Gay 379*, GH, type).
S. mandonii Sch. Bip. (*Mandon 246*, GH, type).
S. menthaefolia Sch. Bip. (*Claussen s.n.*, US, isotype).
S. microchaeta Sch. Bip. (*Botteri 487*, US).
S. mitopoda B.L. Robins. (*Seler & Seler 4286*, GH, type).
S. neglecta Rusby (*Bang 611*, US, isotype).
S. nepetaefolia H.B.K. (*Purpus 1484*, US).
S. obovata Rusby (*Bang 1027*, US, type).

- S. obovata* var. *aristifera* B.L. Robins. (Steinbach 8831, GH, type).
S. ophryophylla B.L. Robins. (Brade 7084, GH, type).
S. organoides H.B.K. (Pringle 8703, US).
S. organensis Gardn. (Gardner 512, US, type frag.).
S. orizabensis B.L. Robins. (Bourgeau 3331, GH, type).
S. paniculata Lag. (Carter & Chisaki 3475, US).
S. pennellii B.L. Robins. (Pennell 13883, GH, type).
S. plummerae A. Gray (Rusby 157½, US; Harrison 3054, US; Pereyra 5823, GH, type of *S. mercedensis* Hieron. var. *pereyrae* B.L. Robins.).
S. purdiei B.L. Robins. (Purdie s.n., GH, type).
S. purpusii B.L. Robins. (Pringle 11294, US, isotype).
S. rebaudiana Bertoni (Jack 5353, US).
S. reclinata Rusby (R.S. Williams 1468, US, type).
S. rhombifolia H.B.K. (Cronquist 9555, US; Ferrera 7198, US).
S. rhombifolia f. *colorata* B.L. Robins. (Palmer 958 in 1896, US, type).
S. rhombifolia var. *stephanocoma* Sch. Bip. (Gentry 7304, US).
S. rhombifolia var. *stephanocoma* f. *glandulifera* B.L. Robins. (Pennell 18504, US).
S. riedelii Sch. Bip. (Riedel s.n., GH, type).
S. rosei B.L. Robins. (Rose 2994, US, type).
S. sarensis B.L. Robins. (Steinbach 7048, GH, type).
S. sarensis var. *dissiticeps* B.L. Robins. (Steinbach 6248, GH, isotype).
S. satureiaefolia Sch. Bip. var. *hirsuta* (Hook & Arn.) Baker (Cronquist 9720, US).
S. scabridula B.L. Robins. (Palmer 592 in 1886, US, isotype).
S. seemannii Sch. Bip. var. *selerorum* B.L. Robins. (Seler 1602, GH, type).
S. serrata Cav. var. *arguta* B.L. Robins. (Pringle 7652, GH, type).
S. serrata var. *haplopappa* B.L. Robins (Palmer 750 in 1896, US, isotype).
S. serrata var. *ivaefolia* B.L. Robins. (Pringle 8229, US, type of *S. tephra* B.L. Robins.).
S. tomentosa H.B.K. var. *seatonii* B.L. Robins. (H.E. Seaton 487, GH, type).
S. trachelioides DC. (Berlandier 1164, US, isotype).
S. urticaefolia Thunb. var. *pallidiflora* B.L. Robins. (Bang 2877, US, type).
S. villaricensis (B.L. Robins.) Cabrera & Vittet (Jorgensen 4267 in part, GH, type).
S. weberbaueri B.L. Robins. (Weberbauer 7293, US, type).
S. yaconensis Hieron. var. *subeglandulosa* Hieron. (Fiebrig 2330, GH, type).

In a final group the entire outer surface of the corolla tends to be very hairy:

- S. hypomalaca* B.L. Robins. (Pringle 6603, US, isotype).

- S. jaliscensis* B.L. Robins. (*Pringle* 1773, US, isotype).
S. lemmonii A. Gray (*Lemmon* 149 in 1881, GH, type).
S. liebmannii Sch. Bip. ex Klatt (*Pringle* 4974, US, type of *S. decumbens* Greene).
S. lilloi B.L. Robins. (*Lillo* 15926, GH, type).
S. micrantha Lag. (*Pennell* 19275, US; *Wright* 1130, US, isotype of *S. macella* A. Gray).
S. palmeri A. Gray (*Palmer* 30 in 1885, US, type).
S. schreiteri B.L. Robins. (*Schreiter* 3637, GH, type).
S. serrata Cav. (*Blumer* 1478, US).
S. serrata Cav. var. *haplopappa* B.L. Robins. (*Palmer* 750 in 1896, US, isotype).
S. serrata Cav. var. *ovalis* B.L. Robins. (*Palmer* 309 in 1886, US, type).

In one of these, *S. schreiteri*, hairs occur almost to the exclusion of glands which are few and restricted to the lobes of the corolla.

In a few cases the same species may occur in different lists. In some cases this may be the result from real variation in the species. In others it may represent species concepts that need reevaluation. For example in *S. serrata* most material is densely hairy throughout, but some varieties appear to have sparse pubescence in the middle. In some material of *S. plummerae* hairs are restricted to the upper part, but often there are some hairs on the lower part. In contrast to these variations the *S. pilosa* and *S. salicifolia* groups have related species showing similar types of pubescence. When the limits of variation of the other species are determined other such related groups may become evident.

IV Base of the style.

In one group of specimens, all of which lack external hairs on the upper part of the corolla, the base of the style has projecting cells forming papillae or in the extreme even short filaments. These have been seen in the following material:

- S. glutinosa* H.B.K. (*Morley* 653, US).
S. pyrolaefolia Schlecht. (*H.E. Moore* 1738, US).
S. salicifolia Cav. (*Cronquist* 9531, US; *Rose, Painter, Rose* 8275, US).
S. salicifolia Cav. var. *anathera* B.L. Robins. (*Palmer* 401, US, isotype).
S. salicifolia Cav. var. *collodes* (Greenm.) B.L. Robins. (*Pringle* 8570, US, isotype).
S. salicifolia Cav. var. *integra* (Blake) B.L. Robins. (*Purpus* 4722, US, type).
S. salicifolia Cav. var. *nana* A. Gray (*Parry & Palmer* 326 in 1878, US, type).
S. salicifolia Cav. var. *virgulifera* B.L. Robins. (*Palmer* 29 in 1896, US, isotype).
S. venosa A. Gray (*Palmer* 376 in 1885, US, type).
S. vernicosa Greenm. (*Pringle* 7698, GH, type).

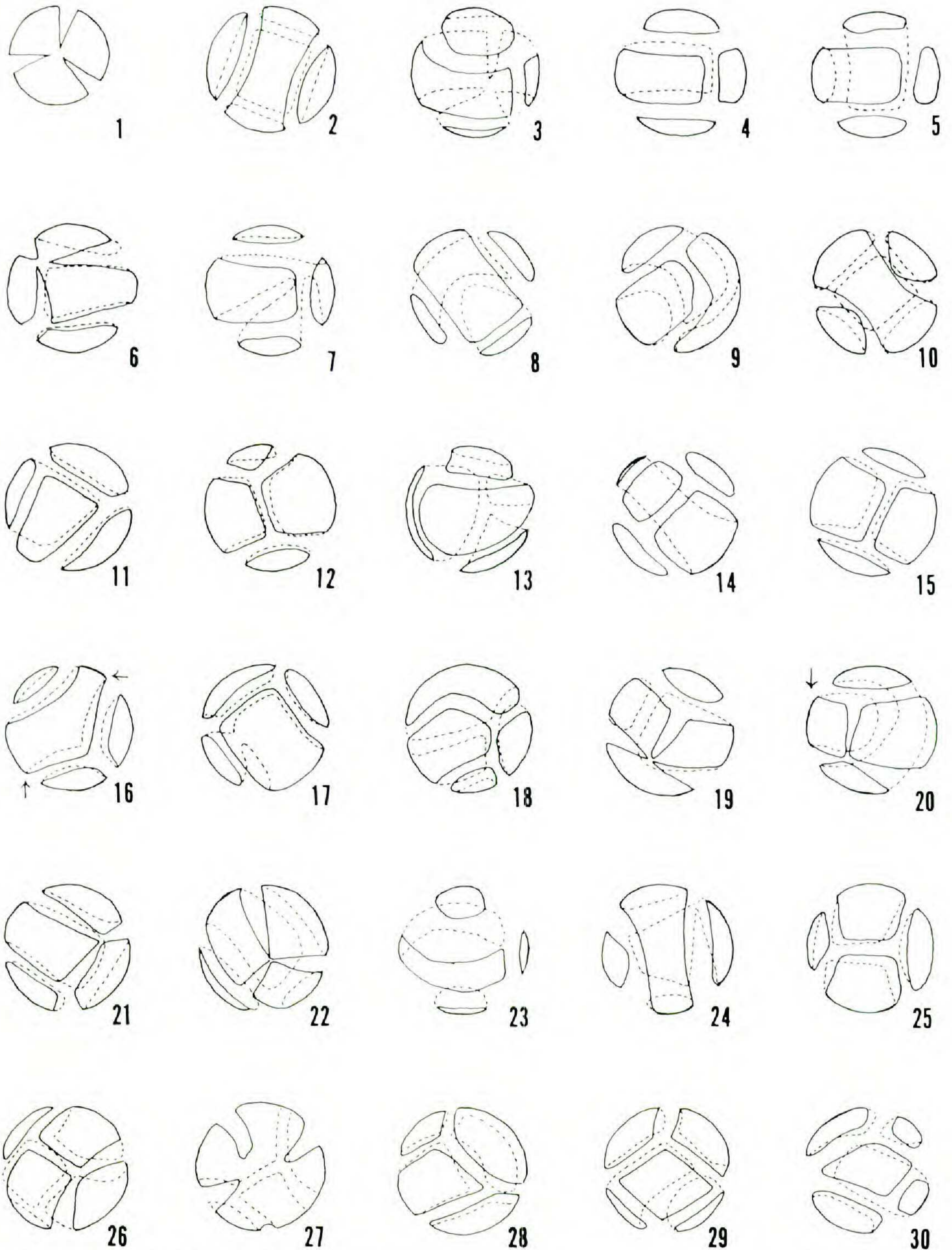
This character seems to reflect unquestionably a related group and has

not been seen in any other species of the genus. This is not necessarily a key character for the group as one specimen of *S. salicifolia* showing other characters of the species, lacks the papillae on the style. Still, the papillae are present on all other material of *S. salicifolia* and its close relatives that have been seen and distinguishes them from specimens of *S. lucida*, the other common species lacking hairs on the backs of corolla lobes.

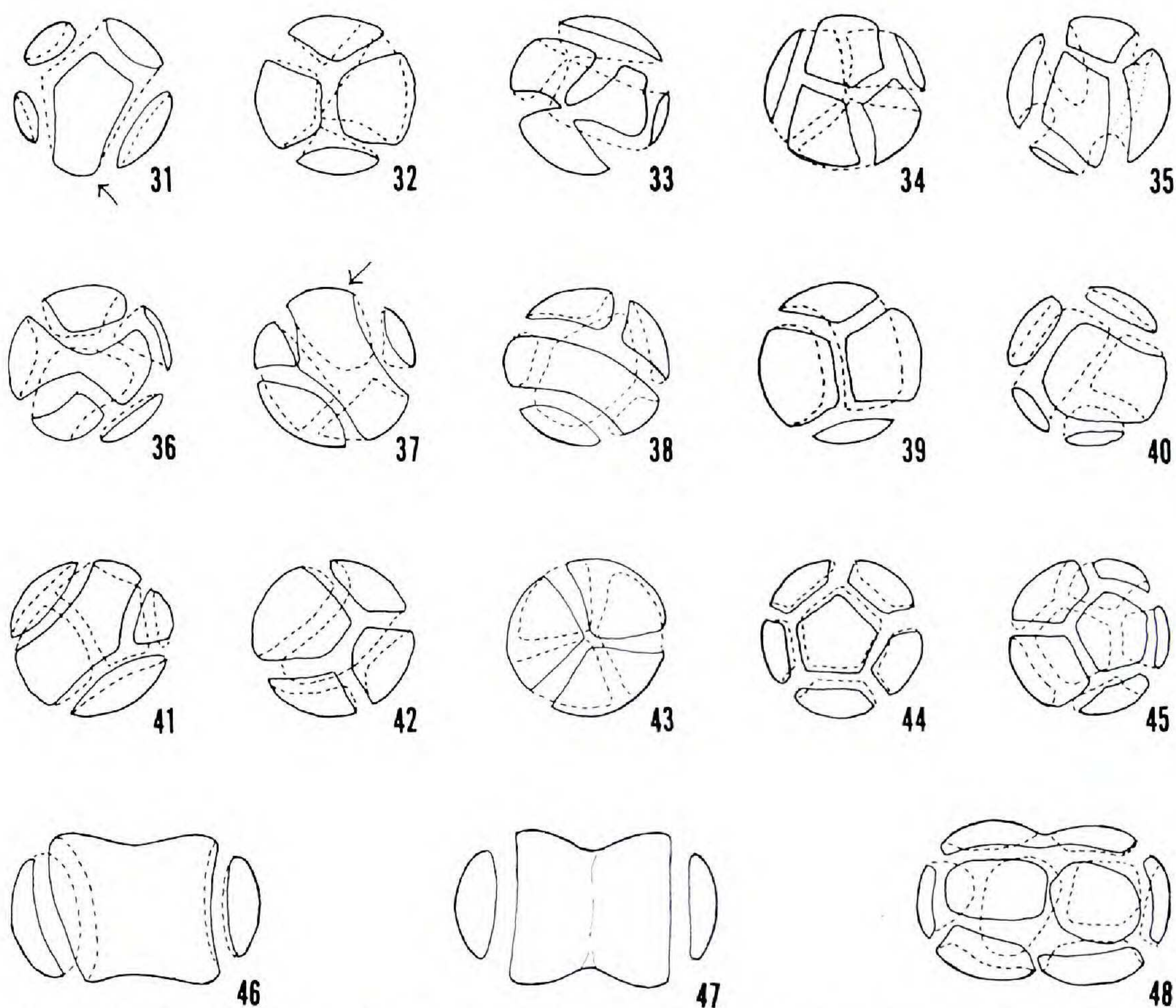
Within the *S. salicifolia* group there are two species, *S. vernicosa* and *S. salicifolia* var. *collodes* showing distinct flower features. In *S. vernicosa* the achene bears some glands, a character so far found only occasionally in *S. lucida* and *S. dictyophylla* and otherwise restricted to South American species. This may indicate a closer relationship of this group to the multiaristate species of South America than to the species with modified pollen in Central America. In *S. salicifolia* var. *collodes* the corolla bears many hairs on the lower part as does *S. lucida*. The relationship of the variety *collodes* otherwise seems to be clearly with *S. salicifolia* which very rarely has one or two external hairs on the corolla.

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Figs. 1-30. *Stevia* pollen, schematic, spines and pores not shown, arrows indicating possible hidden furrows. 1. Pollen type I. 2-30. Pollen type II. 2-5. *S. alatipes* (Pringle 10124, US). 6. *S. connata* (Bourgeau 3243, US). 7-9. *S. elongata* (King & Soderstrom 3111, US). 10-11. *S. monardae-folia* (Pringle 743, GH). 12-13. *S. pilosa* (Berlandier 663, US). 14-16. *S. purpusii* (Pringle 11294, US). 17-18. *S. rhombifolia* (Palmer 958, US). 19-22. *S. satureiaefolia* (Cronquist 9720, US). 23-24. *S. viscida* (Palmer 791, US). 25-29. *S. plummerae* (Harrison 3054, US). 30. *S. seemannii* (Seemann 2041, GH).



Figs. 31-48. *Stevia* pollen, schematic, spines and pores not shown, arrows indicating possible hidden furrows 31-45. Pollen type II. 31-32. *S. seemannii* (Seemann 2041, GH). 33-35. *S. seemannii* var. *selerorum* (Seler 1602, GH). 36-38. *S. tomentosa* (Seaton 487, GH). 39-45. *S. micradenia* (Pringle 5051, US). 46-48. Pollen type III. 46-47. *S. pilosa* (Pringle 9547, US). 48. *S. purpurea* (Palmer 463, US).